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RAIL AND ROAD TRANSPORT IN THE SUDAN

John F. Due

#423

(Transportation Paper #15)

**College of Commerce and Business Administration
University of Illinois at Urbana-Champaign**



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July 25, 1977

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$$\frac{d}{dt} \left(\frac{1}{2} m \dot{x}^2 \right) = m \dot{x} \ddot{x}$$

$$= m \dot{x} \left(-\frac{1}{m} \frac{d}{dt} \left(\frac{1}{2} m \dot{x}^2 \right) \right)$$

$$= -\dot{x} \frac{d}{dt} \left(\frac{1}{2} m \dot{x}^2 \right)$$

$$\frac{d}{dt} \left(\frac{1}{2} m \dot{x}^2 \right) = 0$$

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$$\frac{d}{dt} \left(\frac{1}{2} m \dot{x}^2 \right) = \frac{d}{dt} \left(\frac{1}{2} m \dot{x}^2 \right)$$

ABSTRACT*

It is generally recognized that inadequate transportation has been a major obstacle to economic development in the Sudan. The inefficiency in recent years of the rail system and the very limited road development have without question hampered development. Difficulties with the railway, in turn, led to increased attention to road transport and the building of the pipeline—which will aggravate the financial problems of the railway. Yet the potential is substantial: the rail system is one of the most extensive in Africa, covering virtually all the producing areas and towns except in the far south, and cost per ton kilometer is clearly less than that of road transport. The great problem is: how to improve rail efficiency, and to this the government is giving substantial attention. Sudan faces the same problem that confronts other African countries with substantial rail systems: rail costs are substantially lower than road transport costs with adequate traffic, but poor rail service results in diversion to road and improvements in nonrail facilities--thus aggravating the problem with the railways. There are also long-range problems with the light traffic lines which are relatively long; unless traffic volume increases materially on these, it may be desirable ultimately to consider abandonment. This is not contemplated, quite wisely at present. There is very little likelihood of any additional rail construction, except the rebuilding of the line into Suakin as this port is developed to supplement Port Sudan, now operating nearly to capacity.

*The author is indebted to the Center for International Comparative Studies, University of Illinois, for a grant to visit the Sudan in May 1977.

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RAIL AND ROAD TRANSPORT IN THE SUDAN *

The Democratic Republic of the Sudan is the largest country in Africa in area, with a population of about 18 million, heavily concentrated around Khartoum and the area to the south of the city. Much of the northern third is desert. Primarily an agricultural country, the Sudan is a major exporter of cotton, grown primarily on irrigated land in the Gezira, between the two branches of the Nile south of Khartoum. Most of the remainder of agricultural production is to the south and southwest of Khartoum. There is in addition substantial livestock production, primarily by nomadic tribes. Industry, heavily concentrated around Khartoum, is of relatively recent origin. Historically the main trade route to the Sudan was up the Nile Valley (the Nile was never navigable throughout because of cataracts), but in recent decades most import and export traffic is handled via Port Sudan on the Red Sea. There is some overland trade with countries to the south and southwest. Land transport in the Sudan is inherently difficult in view of the long distances with limited intermediate traffic and the harsh deserts.

The railway system, with 4,756 kilometers of line (2,956 miles) is currently the largest single system in all tropical Africa, second to East African Railways when that system functions as a unit. Furthermore, the Sudan remained almost entirely dependent on rail transport longer than virtually any other country in the world; only since the early 1970s has road transport come to play any significant role in transport, although it is now expanding rapidly. River transport is a minor element in the total picture.

* The author is indebted to officials of the Ministry of Planning, Democratic Republic of the Sudan, for their assistance.

Experience in several other tropical African countries in the transport field is presented in "Some Observations on Rail and Road Transport in Commonwealth Tropical Africa", Transportation Research Paper # 14, College of Commerce, University of Illinois, April, 1977.

Development of the Railway System

Initial railway development in the Sudan resulted from military activity rather than economic considerations. From 1820 on, the Sudan was ruled by Egypt, itself dominated by Turkey, and to an increasing degree as time went on influenced by the British. But the foreign rule was tenuous at best, and the first rail line, started in 1875 from Wadi Halfa on the border with Egypt to bypass cataracts on the Nile, and reaching Sarras, 33 miles upstream, was designed to supply the garrison at Sarras. In the early 'eighties, the Sudanese revolted under the leadership of the Mahdi, and besieged the Egyptian forces in Khartoum, now led by British General Charles Gordon. In an effort to rescue Gordon, the Egyptians and British sent an expedition north up the Nile and extended the railway another 54 miles to Akasha, in 1885. In the same year British forces also commenced to build a railway from Suakin, the old Red Sea port, toward the Nile, and 20 miles of track were laid. But the Egyptian forces in Khartoum were overwhelmed in January of 1885 and General Gordon's head was cut off on the steps of the Palace leading down to the Nile. The two rail lines were torn up by the Sudanese as a protection element, except the Wadi Halfa-Serras portion, but this did not operate.

For more than a decade, Sudan remained independent and isolated. This defeat the British could not tolerate, and massive plans were developed to invade the Sudan in force and in cooperation with the Egyptians take the country back. As a part of this project, under General Kitchener, the rail line south from Wadi Halfa was restored, and laboriously extended to Abu Fatma, 200 miles from Khartoum, bypassing the third cataract.¹ But it was

1. The railroad developments during the period of Kitchener's reconquest are described by Winston Churchill in The River War (London: Eyre and Spottiswoode, 1899).

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decided by the British command that to extend this on toward Khartoum was dangerous from a military standpoint, and that a direct line was needed south from Wadi Halfa, cutting across the neck of the great loop of the Nile, in an area of some of the most forbidding desert in the world. But by 1898 the line had been completed 385 miles to Atbara, where the Atbara river joins the Nile. The railroad played a major role in the inevitable success of the British expedition.¹ The line was pushed on to Khartoum late in 1899--and the old capital now had a direct link with navigation on the Nile in Egypt. But the new government (Sudan had become the Anglo-Egyptian Sudan, and thus in fact under British domination) recognized that this rail-water route was not adequate for import and export trade, and in 1904-05 built from Atbara to the old port of Suakin and on to the new harbor at Port Sudan in 1906. This route, from Khartoum via Atbara to Port Sudan, has been the major route since that time and greatly facilitated import and export trade.²

Further expansion of the system was spread over several decades, the major steps being as follows:

1. From a point just north of Abu Hamed, to Karima, on the Nile, to connect with the river service from Karima to Dongola on the navigable stretch of the river between the third and fourth cataracts.

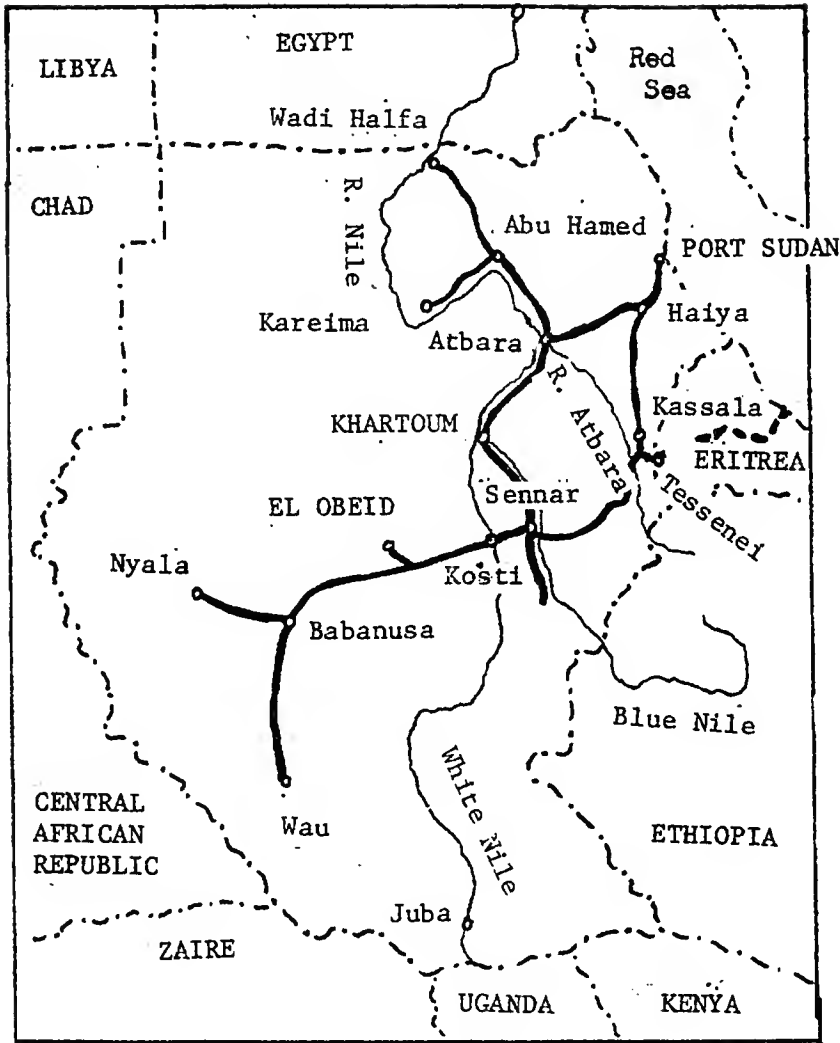
2. Southward, from Khartoum to Sennar in 1909 and to El Obeid, the largest city in the Sudan outside the Khartoum area, in 1912.

3. A line from the Port Sudan route at Haifa southwestward via Kassala (1924) and Gedaref (1928), to connection with the Khartoum-Sennar line at the latter point in 1929.

1. This expedition was an extreme instance of "prestige" imperialism at its worst.

2. The old line down the river from Wadi Halfa was abandoned in 1905.

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miles

SUDAN RAILWAYS

Fig. 1

1. Introduction

2. Methodology

3. Results

4. Discussion

5. Conclusion

4. Post World War II construction, designed to improve agricultural production in the south and southwest:

- a. South from Sennar to El Damazine, 1954.
- b. Southwest from a junction near El Obeid to Babanousa (1957), and Nyala (1959), and from Babanousa to Wau (1961).

A few other short segments have been built, some of them later removed.

The Lines

Table I provides available data on the various lines, with traffic density figures for 1976. A brief description of each line should aid in understanding the system:

1. The main line, Khartoum-Port Sudan via Atbara. The traffic density on this line is between 2 million and $2\frac{1}{2}$ million net ton miles per mile of line. This compares with Zambia Railways, the expected traffic on TAZARA, and the Tanzania Central line; it is substantially less than the Mombasa-Nairobi line of East African. This line carries about two-thirds of the total traffic of the system. Most imports move first to Khartoum and then out to the final destination. The inbound traffic is about twice as great as the outbound traffic. The imports consist primarily of petroleum products and a wide variety of manufactured goods and materials, the export traffic, farm products, with cotton dominant. The line follows the Nile north from Khartoum, turns east at Atbara to climb gradually up to 3,000 feet at the divide, and drops through rolling country to Port Sudan.

2. The southwestern line, down through the cotton-raising irrigated Gezira, then southwestward through the gum Arabic section at El Obeid,

ultimately to farming areas centering on Wau and Nyala. The lines carry a limited amount of traffic for Chad and the Central African Empire.

3. The Haifa-Kassala-Sennar, secondary main line, carries much of the export produce and brings in imports to the cities and towns. Traffic from the southwest line and the El Damazine branch has of course the alternative route via Khartoum, but much of the export traffic goes directly via Kassala. The El Damazine branch, with relatively light traffic, carries the farm produce of this area, but a substantial amount is now hauled by road transport to Sennar.

4. The Northern lines, to Karima primarily hauling inbound traffic to connect with river barges that serve the towns along this portion of the Nile, and the original line to Wadi Halfa, now handling only limited traffic.

The lines were operated as a government department until 1954, when Sudan Railways Corporation, wholly government owned but with some autonomy, was created.

The Sudan Railways has never connected with lines of other countries, though links have been proposed, and the gaps are relatively small. The Egyptian system ends near Aswan, roughly 100 miles north of Wadi Halfa, and there has been talk at times of closing this gap. But the Egyptian Railways use standard (4'8½") gauge and through service would not be possible. In the southeast, less than 60 miles once separated the end of the Sudan Railway Tessenai branch and the end of the Eritrean lines at Biscia. This latter route

Table I
Data on the Lines of the Sudan Railways

	Kilo- meters	Miles	Weight of rail 3	Metric tons 1976 000s	Net (short tons) 1976 000s	Practical capacity, number of trains daily 1975	Actual number of trains daily	Trains operating as percent of capacity	Average actual time, passenger trains	Passenger trains per week
Main Line										
Khartoum-Atbara	313	195	90	1979	2177	22.4	10.8	48	18	10
Atbara-Haiya	271	168	90	1986	2185	23.4	11.6	50	36	3
Haiya-Port Sudan	203	126	90	2358	2594	21.4	17.2	80		6
total	787	489								
Kassala Line										
Haiya-Kassala	347	216	75	372	409	20	5.6	28	22.1	3
Kassala-Sennar	455	283	75	341	375	17.9	5.0	28	28	3
Sennar-El Damazine	227	141	50	93	102	11.4	2.8	25		2
Southwestern Lines										
Khartoum-Sennar	270	168	75	837	921	23.9	8.9	37	19	16
Sennar-El Obeid	354	220	75	837	921	21	3.5	17	40	4
El Obeid-Babanousa	354	220	50	258	284	9.4	2.5	27	22	3
Babanousa-Nyala	335	208	50	164	180	12.3	1.8	15	20	2
Babanousa-Wau	445	277	50	87	96	7.2	1.3	18	36	2
Northern Lines										
Atbara-Abu Hamed	270	168	75	134	147	19.3	2.4	6		6
Abu Hamed-Karima	222	138	50	92	101	7.4	1.5	11	30 ²	3
Abu Hamed-Wadi Halfa	341	212	50	50	55	7.4	.9	11	37 ²	2

1. Kassala-Pt. Sudan

2. From Atbara

3. Pounds per yard

Source: Various tables in Sudan, Transport Statistical Bulletin, 1975; data supplied by Sudan Ministry of Planning.

extends eastward via Asmara to Massawa, one of the most severe stretches of mountain railway anywhere in Africa. But the western portion of the Eritrean lines has been abandoned and the Eritrean system disorganized by the secessionist movement. Relations between Sudan and Ethiopia, traditionally hostile, have been aggravated by the quarrel over Eritrean independence. Should Eritrea become independent, connection of the two lines is not impossible--but given the grades of the Asmara line and the preference of Sudan to have foreign trade move via Port Sudan, it would not be of great potential use. In the south, the gap is much greater--about 300 miles between Wau and the end of East African Railways (EAR) at Pachwach in Uganda. There has been discussion of building such a line, and also of a line to connect with East African Railways in Kenya but this gap is still greater. Furthermore, EAR uses metre gauge, Sudan, the 1.067 metre Cape gauge. But it is interesting to note that with Tazara completed, the old Cape to Cairo dream has only two gaps--Pachwach to Wau and Wadi Halfa to Aswan. Were East African converted to 1.067 gauge and the break at the Kenya-Tanzania border closed, as well as the two gaps above, freight could move through--except for political obstacles--from Cape Town to Cairo, with only one transfer, at Aswan. More practically, freight could move from Lusaka to Khartoum.

Traffic Composition

Table 2, reproduced from the Transport Statistical Bulletin, Sudan, for 1975, shows the traffic volume by commodity 1961-62 to 1974-75, and Table 3, the trend in imports, exports, animal, and local freight traffic since 1955/56.¹ There was a steady upward trend 1956-64, a decline to 1968, a rise to 1971, a decline to 1975 with a loss of about one-sixth of the tonnage over the four

1. Virtually all data in the Sudan are expressed in fiscal years (July 1-June 30). Only the ending year of each fiscal year is shown subsequently.

Table 2.

Rail Freight Traffic by Major Commodities
(000 Tons)

	1961-62		1963-64		1965-66		1967-68		1969-70		1970-71		1971-72		1972-73		1973-74		1974-75	
	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
Cotton & Cotton Seed	398	14.9	271	8.1	321	11.4	371	13.9	511	16.3	370	11.6	395	13.0	227	7.8	266	9.9	179	7.2
Livestock	29	1.1	30	0.9	38	1.4	40	1.5	53	1.7	40	1.3	29	1.0	29	1.0	28	1.0	25	1.0
Rail Own Traffic	220	8.2	253	7.6	209	7.4	121	4.5	130	4.1	107	3.4	117	3.8	101	3.5	103	3.8	102	9.4
Other Oil Seed	81	3.0	118	3.5	82	2.9	138	5.2	124	4.0	96	3.0	108	3.5	116	4.0	106	3.9	54	2.4
Oil Cakes	79	3.0	166	5.0	153	5.4	144	5.4	117	3.7	195	6.2	119	3.9	97	3.3	34	1.3	67	2.7
Maze and Millet	100	3.7	116	3.5	172	6.1	103	3.9	270	8.6	252	8.0	296	9.7	185	6.3	165	6.1	93	3.7
Flour, Wheat & Rice	95	3.5	136	4.1	134	4.8	157	5.9	242	7.7	306	9.6	237	7.8	212	7.3	222	8.3	174	6.9
Cement	88	3.3	119	3.6	64	2.3	120	4.5	160	5.1	152	4.7	149	4.9	136	4.7	138	5.2	146	5.8
Sugar	134	5.0	163	4.9	168	6.0	133	5.0	124	4.0	179	5.6	167	5.5	156	5.3	156	5.2	136	5.4
Timber, Charcoal & Firewood	44	1.6	69	2.1	45	1.6	44	1.7	87	2.8	72	2.3	61	2.0	38	1.3	48	1.8	43	1.7
Cars, Iron & Steel & Glass	58	2.2	73	2.2	30	1.1	36	1.3	97	3.1	93	2.9	87	2.9	61	2.1	79	2.9	51	2.0
Petroleum Products	419	15.7	411	12.3	395	14.0	450	16.9	590	18.8	604	19.1	642	21.1	601	20.6	591	22.0	618	24.6
Fertilizers & Insecticides	77	2.9	88	2.6	63	2.2	82	3.0	115	3.7	117	3.7	118	3.9	100	3.4	167	6.2	155	6.2
Chemicals & Medicines	5	0.2	3	0.1	3	0.1	5	0.2	11	0.3	18	0.6	21	0.7	12	0.4	13	0.5	10	0.4
Jute Products	18	0.7	23	0.7	17	0.6	27	1.0	22	0.7	29	0.8	21	0.7	29	1.0	29	1.1	28	1.4
Salt	47	1.7	44	1.3	43	1.5	41	1.5	44	1.4	49	1.5	59	1.9	63	2.1	56	2.1	59	2.3
Tea	10	0.4	9	0.3	10	0.4	7	0.3	8	0.3	10	0.3	11	0.4	12	0.4	1	-	-	-
Paper	5	0.2	5	0.2	3	0.1	5	0.2	7	0.2	12	0.4	10	0.3	14	0.5	9	0.4	8	0.3
Miscellaneous	768	28.7	1230	37.0	863	30.7	642	24.1	423	13.5	478	13.5	387	13.0	711	25.0	491	18.3	538	21.4
Total	2675	100	3327	100	2813	100	2666	100	3135	100	3169	100	3034	100	2901	100	2684	100	2516	100

Source: Sudan Railways Annual Reports.

Note: Freight traffic includes rail revenue traffic plus rail's own traffic.

Table 3.

Sudan Railways Freight Traffic by Type
(Traffic in 000 Tons)

Years	Rail Export Traffic		Rail Import Traffic		Rail Local Traffic		Rail Animal Traffic		Rail Own Traffic		Total Rail Traffic	
	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
1955/56	628	33	545	29	488	26	58	3	170	9	1889	100
1956/57	614	31	593	30	515	26	61	3	195	10	1978	100
1957/58	513	25	738	36	909	25	57	3	220	11	2037	100
1958/59	651	29	688	31	610	27	31	2	249	11	2229	100
1959/60	706	31	768	34	546	24	35	2	216	9	2271	100
1960/61	726	31	869	36	533	22	44	2	205	9	2377	100
1961/62	746	28	1078	40	602	23	29	1	220	8	2675	100
1962/63	981	32	1252	41	594	19	25	1	222	7	3074	100
1963/64	885	27	1558	47	601	18	30	1	253	7	3327	100
1964/65	805	29	1238	43	556	20	27	1	193	7	2819	100
1965/66	842	30	1109	39	615	22	38	1	209	8	2813	100
1966/67	781	27	1125	39	724	25	40	2	194	7	2864	100
1967/68	813	31	1090	41	602	23	39	-	121	5	2665	100
1968/69	929	31	1287	42	650	21	38	1	147	5	3051	100
1969/70	843	27	1384	44	725	23	53	2	130	4	3135	100
1970/71	872	28	1532	48	618	20	40	1	107	3	3169	100
1971/72	923	30	1460	48	505	17	29	1	117	4	3034	100
1972/73	854	29	1421	49	495	17	30	1	101	4	2901	100
1973/74	697	26	1379	51	477	18	28	1	103	4	2684	100
1974/75	644	26	1312	52	434	17	26	1	102	4	2517	100

Sources Sudan Railways Returns.

Note : Rail Revenue Traffic = Total Rail Freight Traffic-Rails own Traffic.

Reproduced from Sudan, Transport Statistical Bulletin, 1975

years, though with little change in the import portion, and then a rise (not shown in the table) in 1976. The 1975 traffic was well above that of the late 'fifties--but of course constituted a smaller percentage of both total transport and GDP.

The overall figures, however, disguise the changes in traffic on the various lines. The pattern, which appears in Fig. 2, has been as follows:

1. The trend has been upward in traffic on the main Khartoum-Port Sudan line in recent years, but on no others.

2. Volume has been relatively constant, trendwise, on the Khartoum-El Obeid and Sennar-Kassala-Haiya lines.

3. All of the other lines--all of the relatively light traffic lines--have shown a downward trend. The worst are the El Damazine line, which had lost three-fourths of its 1970 traffic by 1976, and the Wadi Halfa line, which had lost two-thirds. The Karima line had lost half of its traffic.

As shown in Table 2, the pattern has been very different on different commodities. Petroleum products, fertilizer, cement, flour and wheat have done the best, whereas by far the most serious decline has been in cotton and cottonseed, a loss of more than half the traffic, on an item that was once the major category of traffic carried. Other oil seeds and oil cakes have fallen drastically as well. Other major items have remained much the same. The annual variations in export farm products are very great because of fluctuations in crop yields; these changes also affect imports by altering foreign exchange earnings.

Table 2 also indicates the relative importance of various elements in recent years. Petroleum has been accounting for about one-fifth of the total traffic, and no other single item approaches it. Cotton and cotton seed,

1975/76 42

1974/75	35	000 TONS
1973/74	51	" "
1972/73	29	" "
1971/72	56	" "
1970/71	113	" "

1974/75	2618	000 TONS
1973/74	2068	" "
1972/73	2213	" "
1971/72	2213	" "
1970/71	2182	" "

1974/75	1639	000 TONS
1973/74	1215	" "
1972/73	1212	" "
1971/72	1650	" "
1970/71	1650	" "

W. HALFA (50 lb.)

1975/76 1986

HAIFA (90 lb.)

1974/75	90	000 TONS
1973/74	79	" "
1972/73	120	" "
1971/72	131	" "
1970/71	185	" "

1974/75	125	000 TONS
1973/74	130	" "
1972/73	192	" "
1971/72	182	" "
1970/71	278	" "

1974/75	1498	000 TONS
1973/74	1659	" "
1972/73	1835	" "
1971/72	1838	" "
1970/71	1102	" "

1974/75	325	000 TONS
1973/74	209	" "
1972/73	218	" "
1971/72	468	" "
1970/71	504	" "

KAHIRA

331

1974/75	1498	000 TONS
1973/74	1659	" "
1972/73	1835	" "
1971/72	1838	" "
1970/71	1102	" "

1974/75	294	000 TONS
1973/74	240	" "
1972/73	183	" "
1971/72	360	" "
1970/71	411	" "

1975/76 134

1975/76 837

1975/76 372

1974/75	294	000 TONS
1973/74	240	" "
1972/73	183	" "
1971/72	360	" "
1970/71	411	" "

MYIA

1975/76 164

1975/76 837

1975/76 372

1974/75	102	000 TONS
1973/74	168	" "
1972/73	167	" "
1971/72	159	" "
1970/71	208	" "

1974/75	639	000 TONS
1973/74	762	" "
1972/73	889	" "
1971/72	766	" "
1970/71	735	" "

1974/75	294	000 TONS
1973/74	240	" "
1972/73	183	" "
1971/72	360	" "
1970/71	411	" "

335

1974/75	172	000 TONS
1973/74	103	" "
1972/73	248	" "
1971/72	241	" "
1970/71	296	" "

1975/76 258

1975/76 837

1974/75	639	000 TONS
1973/74	762	" "
1972/73	889	" "
1971/72	766	" "
1970/71	735	" "

1974/75	294	000 TONS
1973/74	240	" "
1972/73	183	" "
1971/72	360	" "
1970/71	411	" "

227

1975/76 93

EL DAMAZINE (50 lb.)

448

1974/75	33	000 TONS
1973/74	80	" "
1972/73	182	" "
1971/72	204	" "
1970/71	107	" "

1975/76 87

1974/75	639	000 TONS
1973/74	762	" "
1972/73	889	" "
1971/72	766	" "
1970/71	735	" "

EL DAMAZINE (50 lb.)

VAD

1974/75	33	000 TONS
1973/74	80	" "
1972/73	182	" "
1971/72	204	" "
1970/71	107	" "

1975/76 87

1974/75	639	000 TONS
1973/74	762	" "
1972/73	889	" "
1971/72	766	" "
1970/71	735	" "

EL DAMAZINE (50 lb.)

EL BAHIGUSA

EL GHATD

SENNAR

EL DAMAZINE

INFORMATION SOURCE

- 1- ORGAN RAILWAYS ANNUAL REPORT
- 2- IRSD AROUND RAILWAYS PROJECT 1974

DESTONED BY TRANSPORT SECTION N.P.C.

From Sudan, Transport Statistical Bulletin, 1975.

With 1976 figures added.

Numbers on lines are kilometers; numbers in paren-

flour, wheat, cement, and sugar are the other major items, with comparable tonnages, followed by maize and millet, oil cake and oil seeds.

Traffic Volume

Table I indicates approximate traffic density on the various lines. The figures show tonnage on the lines. No ton mileage figures are available but on most of the lines, the tonnage indicated passes over the entire line, and therefore the ton miles per mile and the tonnage figures are the same. This is not true of the main lines. The heaviest traffic line is the portion from Haifa to Port Sudan, which carries the main line traffic as well as that of the Kassala line. The figures for the Khartoum-Atbara-Haifa portion is about 2 billion net ton miles per mile of line; experience in the US and elsewhere suggests that such lines capture most of the economies of scale and costs are lower than those of road transport.

The next heaviest traffic lines, but with less than half that of the main line, are the southern main lines from Khartoum through the Gezira to Senar, and from Senar on to El Obeid, with nearly a million net ton miles per mile of line. Both portions of the Kassala line, from that city to Haifa and to Senar, have traffic around 400,000 net ton miles, and the portion from the El Obeid junction to the Babanousa junction is close to 300,000. The Nyala, Abu Hamed, and El Dalazine lines carry between 100,000 and 200,000; the remaining lines drop well below 100,000. The long line from Abu Hamed to Wadi Halfa--the original line--has only 55,000 tn/m. The discouraging part is that these light traffic lines are the ones that have experienced drastic declines in traffic; five years ago their performance was much more respectable.

The result is substantial excess capacity, even on the main lines. On the basis of the data in the Transport Statistics Volume for 1975, the practical capacity and the actual number of trains per day in both directions, are shown in Table I. The segment from Haiya to Port Sudan, with 17 trains daily each way and a capacity of 21, is the closest to capacity, and the remainder of the main line is at about 50 percent of practical capacity. Typically 5 or 6 freight trains each way are operated daily on these segments. Khartoum-Sennar, with a capacity of 24 and actual of 9, comes next. Sennar-Kassala and Kassala-Halfa segments average 5 freights daily, again with capacity around 20. The other relatively high capacity line, Atbara to Abu Hamed, averages only 2.4 freights a day. The other lines, with capacity of 7 to 12 trains a day, all have less than 3 a day,

The average tonnage per wagon (freight car) is 21 metric tons (and has been for a decade); the average train hauls around 500 net tons (1,000 gross tons), and 24 cars per train. The percentage of loaded to empty cars is very good compared to many systems, around 80 percent. The most discouraging feature, however, has been the steadily lengthening turnaround time for freight cars; 10 days in 1965, it was 16.5 in 1975. Part of this reflects longer average haul, but much reflects loss in efficiency.

Rail Rates and Costs

In 1975, the overall costs of providing freight service (with, of course, a somewhat arbitrary allocation of costs between freight and passenger service, but one that appears to be reasonable) ^{were} Sudan L 19.8 million, to handle 2,274 million ton kilometers, or, in terms of US cents, 3.2 cents

per ton mile. The figure for the previous year was 2.8 cents; for 1971, 1.43 cents. These figures, however, are based on the current official exchange rate, at which the Sudan L is clearly overvalued; if the L is overvalued by one-third, the cost figure would be 2 cents for 1975 or roughly the same as the average figure in the United States. While good cost data for road transport are not available for the Sudan, there is every indication that road transport costs as noted below are two to three times as high; in terms of transport costs, clearly the rail system is justified, though, as noted, drastic changes are required.

Table 4 shows typical rail rates, for sample commodities, for a variety of distances. Unfortunately all published figures are for agricultural products; since these figures run higher than the average, the inevitable conclusion is that the goods are receiving lower rates.

Several conclusions are suggested by these figures:

1. There is extremely little tapering of rates for the distances indicated; on dura, for example, the rate per ton mile is only slightly higher from Gedaref to Port Sudan than it is from Nyala, though the latter distance is more than $2\frac{1}{2}$ times as great.

2. There remains a substantial element of value of service rate making, a conclusion varified in various unpublished studies to which the author had access.

The rate structure has been subject to some reexamination in recent years, in effort to raise rates that are below out-of-pocket (marginal) cost and at least move in the direction of greater emphasis on cost and less on value of service. But, as noted, much of the latter remains.

1. $\frac{1}{x^2} = x^{-2}$
 $\frac{d}{dx} x^{-2} = -2x^{-3} = -\frac{2}{x^3}$

2. $\frac{1}{x^3} = x^{-3}$
 $\frac{d}{dx} x^{-3} = -3x^{-4} = -\frac{3}{x^4}$

3. $\frac{1}{x^4} = x^{-4}$
 $\frac{d}{dx} x^{-4} = -4x^{-5} = -\frac{4}{x^5}$

4. $\frac{1}{x^5} = x^{-5}$
 $\frac{d}{dx} x^{-5} = -5x^{-6} = -\frac{5}{x^6}$

5. $\frac{1}{x^6} = x^{-6}$
 $\frac{d}{dx} x^{-6} = -6x^{-7} = -\frac{6}{x^7}$

Table 4
Typical Rail Rates Per Ton Mile, 1973, Sudan

Points and Commodities	KM	MI	Mill S of Sudan L per KM	US ¢ per ton mile
Gedaref-Port Sudan	800	497		
Dura (Sorghum)			7.13	2.59
Sesame			12.25	4.54
Ground Nuts			8.25	3.00
El Damazine-Port Sudan	1255	780		
Dura			6.93	2.52
Sesame			11.87	4.31
Ground Nuts			7.97	2.90
Nyala-Port Sudan	2150	1336		
Dura			6.42	2.34
Sesame			11.07	4.02
Ground Nuts			7.44	2.71
Khartoum-Port Sudan	790	491		
Cotton			11.44	4.16
Cottonseed			8.12	3.14
Wheat			4.57	1.66
Oil Cakes			8.86	3.07

Source of data: Sudan, Transport Statistical Bulletin, 1975, p. 36.

Passenger Service

Passenger traffic increased, but in a somewhat erratic fashion, up to 1970-71, and then fell by about 20 percent. Currently, the traffic is only about 10 percent greater than it was in 1955/56, though the population has greatly increased. However, the average length of trip has doubled in the last two decades; the present figure is 374 kilometers (234 miles). Accordingly, total passenger miles reached an all time high in 1975, it was double the figure of two decades earlier. Short-distance traffic has been lost to cars and buses, while long-distance traffic has increased rapidly. Domestic air service is extremely expensive compared to rail and has scarcely affected the rail total. The domestic air travel figure is only 75,000 a year, compared to 3 million rail passengers.

Sudan Railways trains, like those of the old Rhodesia Railways, have four classes: First class (sleepers), and three others. Fourth class remains the dominant type, with 60 percent of the passengers in 1975, but has fallen sharply from 85 percent in 1956. Third class has increased to 30 percent from 10 percent over that period, second from 4 to 8 percent, and sleeping from 1.9 to 3.5 percent. The sleeping car passengers, only 4 percent of the total, yield 20 percent of the revenue (1975). The average fourth class fare in 1975 was \$2.25 (US), for an average trip of 339 kilometers or 212 miles, or about one cent (US) per mile. The first class fare is about 10 cents per mile. Domestic air fares range from 16 to 20 US cents per mile. Bus fares average about 2 US cents per ton mile.

Basic data relating to passenger train frequency and speed is shown in Table I. Because the system does not consist of one main line plus branches as do most African systems, the schedules differ from the common pattern.

But in general, service is less than daily. There are sixteen trains a week each way between Khartoum, Wad Medani, and Sennar, and 10 a week between Khartoum and Atbara. Most of the rest of the main and secondary main lines receive service 3 times a week each way (the Haifa-Port Sudan segment, six, as the trains from both lines run on to Port Sudan). Trains to Sennar go on to El Obeid four times a week. At the other extreme, the lightest traffic branches--Nyala, Wau, El Damazine, and Wadi Halfa--have only twice-a-week service.

The maximum speed permitted is relatively high for Africa, 60 kilometers per hour on the main and secondary main lines, 50 on the branches. The scheduled speeds are much lower--typically around 30 km/hr, with the highest 39, from Haiya to Kassala, and the lowest 15 km/hr (about 9 miles an hour), Babanousa to Wau. The scheduled time is 38 hours Khartoum-Port Sudan, 19 hours, Khartoum- El Obeid, and an incredible 100 hours, Port Sudan to Wau, four days and four nights. But even worse is the actual typical elapsed time. In 1975, 97.4 percent of all passenger trains were late; it was noted in the report that this was an improvement over 1975, in which 99.1 percent were late. Not only were they late, but the extent of lateness was little short of phenomenal, as noted in Table 5 below, for July 1975.

Table 5
Lateness of Passenger Trains, Sudan Railways, July 1975

	Scheduled time	Deviation from schedule as percent of scheduled time
Port Sudan-Khartoum	30	79
Sennar-Kosti	3	385
Kosti-El Obeid	10	156
Khartoum-Sennar	12	63
Atbara-Wadi Halfa	19	100
Wau-Babanousa	26	22
Atbara-Karina	16	99
Port Sudan-Kassala	18	35

Source: Sudan, Transport Statistical Bulletin, 1975.

Thus, for example, the Port Sudan-Khartoum main line trains, scheduled for 30 hours, on the average took 54 hours. The prize for lateness went to the relatively short Sennar-Kosti segment, averaging 12 hours instead of the scheduled 3 hours. The best performance was on the long line to Wau, only at 22 percent off schedule. The delays are partly/the terminals, partly as a result of seriously inadequate communications, plus general inefficiency in operation.

The slow time and the lateness, plus the somewhat deteriorated equipment reflect a great departure from the service described by G. H. Kimble, in Tropical Africa, published in 1960:

"Over the years this line (Wadi Halfa-Khartoum) has come to be regarded, by those who know their railways, as one of the best in the world for service and cuisine and notwithstanding the great heat, for comfort also."¹

The passenger cars, painted what is initially a brilliant white to reflect the sun, carry shields on the top and sides in an effort to reduce the heat, as is done in some buildings in the Sudan. But the cars are not air-conditioned, and the dust and sand and engine smoke do little to relieve the incredible monotony of much of the Sudan countryside. The trip to Wadi Halfa, across an uninhabited desert, the stations numbered instead of named, would try the patience of the most devoted train rider; it makes the dreary Tanzania Central route seem like paradise. In past decades, when this train connected with service on the Nile, it enjoyed^a limited amount of tourist traffic (as late as 1962, East African Railways timetables showed through railroad-steamer service from Nairobi to Cairo.)

The interesting feature is that despite all this, the passenger held up remarkably well. The explanation is to be found in rising incomes

1. New York: Twentieth Century Fund, 1960, p. 430.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in the context of public administration and financial management. The text notes that without reliable records, it is difficult to track the flow of funds and ensure that resources are being used as intended.

2. The second part of the document addresses the challenges associated with data collection and analysis. It highlights that gathering comprehensive data from various sources can be a complex and time-consuming process. However, the benefits of having a robust data set are significant, as it allows for more informed decision-making and the identification of trends and patterns. The document suggests that investing in data management systems and training staff can help overcome these challenges.

3. The third part of the document focuses on the role of technology in modernizing operations. It discusses how digital tools and platforms can streamline processes, reduce errors, and improve communication. For example, the use of cloud-based systems can facilitate data sharing and collaboration across different departments. The text also mentions the importance of ensuring that any technology implemented is secure and compliant with relevant regulations.

4. The fourth part of the document discusses the need for continuous improvement and innovation. It argues that organizations should regularly evaluate their current practices and seek out new ways to enhance efficiency and effectiveness. This can involve experimenting with different approaches, learning from both successes and failures, and fostering a culture of innovation where employees are encouraged to propose and implement new ideas.

5. The fifth part of the document concludes by summarizing the key points and offering final recommendations. It reiterates the importance of a holistic approach that combines strong record-keeping, effective data management, the strategic use of technology, and a commitment to ongoing improvement. The document ends with a call to action, urging all stakeholders to work together to achieve the organization's goals and ensure long-term success.

of many, even if the average family real income has not risen; increased education; the abominable condition of the roads; and the extremely high air fares.

Personnel, Equipment, and Track

Up until 1973, the railway was employing about 40,000 persons--a very high percentage of the estimated 250,000 wage earners in the country. The figure has fallen somewhat, to about 33,000 in 1975. This compares, for example, with Zambia Railways, which has roughly half the ton mileage, and less than 10,000 employees. The United States railway system has about 12 times as many employees, but 70 times the mileage and 550 times the total traffic volume.

The system used a wide variety of steam locomotives, most of British origin. Dieselization began in the 1950s, although steam power was acquired as late as 1956, and by the early sixties the main lines had been dieselized. In 1964 there were 67 diesels and 133 steam locomotives; by 1975 the figure of diesels had risen to 99, while there was still 107 steam locomotives. In general the steam power is used on the light traffic 50-pound rail lines. Unfortunately a great variety of diesel engines has been acquired--partly because of grants and loans from various countries: United States, Great Britain, Germany, Japan, Belgium. This of course complicates repair. In 1975, 50 new main line diesels were added.

As noted, the main lines have 90-pound rail; the secondary main lines, 75; the branches, 50-pound. Most of the former lines are estimated to be in relatively good condition, but the 50-pound branch lines have deteriorated.

The shops and main offices of the railway are in Atbara, 195 miles north of Khartoum.

One feature of the lines is the use of several major bridges--across the Blue Nile at Khartoum on a bridge shared with motor vehicle traffic, across the White Nile at Kosti on the route to El Obeid, one across the Atbara at the city of Atbara and ^{one} west of Kassala. The Kassala line crosses the Blue Nile on the dam at Sennar.

Revenues and Earnings

Prior to the late 1960s, Sudan Railways was a highly profitable undertaking, with operating ratios of 50 in 1938, averaging 68 in the 1957-1964 period, and steadily improving in that period. The 1964 figure was 61 percent--extremely high by any standards. But by the end of the decade the picture had reversed and deteriorated very rapidly in the 1970s. The 1963-70 average was 89.

Up through 1972, as shown in Table 6, reproduced from the Transport Statistical Bulletin, operating expenses were covered, but the operating ratio rose to 87 in 1971. Subsequently, costs rose more rapidly than revenues under inflationary pressures, and thus operating losses have been incurred since 1972, with operating ratios between 104 and 110. The 1976 figures are likely to be somewhat better than those of 1975. The deficits, as well as funds for new capital outlays, are covered by the government. Passenger revenue is a minor segment of the total but not unimportant--about 20 percent. With the cost allocation system used, passenger service shows some deficit, but this is not a large part of the total.

THE HISTORY OF THE UNITED STATES

The history of the United States is a complex and multifaceted story that spans centuries. It begins with the early Native American civilizations, such as the Mayans, Aztecs, and Incas, who built sophisticated societies in the Americas. The arrival of European explorers in the late 15th century marked the beginning of a new era, as they sought to establish trade routes and colonies. The English, in particular, played a significant role in the development of the continent, founding the first permanent settlements and eventually expanding their territory across the eastern seaboard.

The American Revolution (1775-1783) was a pivotal moment in the nation's history, as the thirteen colonies declared their independence from British rule. This led to the signing of the Declaration of Independence in 1776 and the subsequent drafting of the U.S. Constitution in 1787. The Constitution established a federal government with three branches: the executive, legislative, and judicial, designed to ensure a system of checks and balances.

The 19th century was a period of rapid expansion and growth for the United States. The westward movement, often referred to as Manifest Destiny, led to the acquisition of vast territories, including the Louisiana Purchase and the Texas Annexation. This period also saw the rise of the Industrial Revolution, which transformed the economy and society through the use of machinery and mass production. However, the westward expansion also brought about the displacement of Native American populations and the establishment of a system of slavery in the southern states.

The American Civil War (1861-1865) was a defining moment in the nation's history, fought between the Union and the Confederacy over the issue of slavery. The war resulted in the preservation of the Union and the eventual abolition of slavery. The Reconstruction era (1865-1877) followed, as the nation sought to rebuild and integrate the newly freed African Americans into the social and political fabric of the country.

The 20th century was a period of significant change and progress for the United States. The country emerged as a global superpower following World War II, leading the world in economic, military, and cultural terms. The civil rights movement, led by figures such as Martin Luther King Jr., fought for the equality of African Americans and led to the passage of landmark legislation, including the Civil Rights Act of 1964 and the Voting Rights Act of 1965. The space race between the United States and the Soviet Union culminated in the Apollo 11 mission, which landed the first humans on the moon in 1969.

The late 20th and early 21st centuries have seen continued challenges and achievements for the United States. The end of the Cold War led to a period of relative peace and global cooperation, but also the rise of new superpowers and the emergence of global issues such as climate change and terrorism. The 2008 financial crisis and the subsequent Great Recession tested the resilience of the American economy, while the 2010s saw the rise of the digital age and the increasing influence of technology in society.

As the United States continues to evolve, it remains a nation of diverse people and cultures, united by a shared history and a common vision of a better future. The story of the United States is one of resilience, innovation, and the pursuit of freedom and justice for all.

Table 6.

Sudan Railways Operating Costs and Revenue
(LS Million)

Year	Total Operating Costs		Total Operating Revenue		Operating Costs as a % of Operating Revenue	Passenger Operating Cost		Passenger Operating Revenue		Operating costs as a % of Operating Revenue	Freight Operating Cost		Freight Operating Revenue		Operating costs as a % of Operating Revenue
	Total	Index	Total	Index		Total	Index	Total	Index		Total	Index	Total	Index	
1968/69	16.59	100	17.06	100	97%	3.32	100	3.34	100	99%	13.26	100	13.71	100	97%
1969/70	16.13	97	18.85	110	86%	3.81	115	3.72	114	102%	12.32	93	15.13	110	81%
1970/71	16.96	102	19.20	113	88%	3.60	108	3.82	114	94%	13.37	101	15.37	112	87%
1971/72	17.85	108	19.61	115	91%	4.26	128	3.91	117	109%	13.60	103	15.70	115	87%
1972/73	19.44	117	19.20	113	101%	3.82	115	4.20	126	91%	15.62	118	15.00	109	104%
1973/74	21.96	132	20.35	119	108%	4.48	135	4.43	133	101%	17.48	132	15.92	116	110%
1974/75	24.24	146	22.81	134	106%	4.42	133	4.00	120	111%	19.82	149	18.81	137	105%

Source: Sudan Railways Annual Reports.

Reproduced from Sudan, Transport Statistical Bulletin, 1975

Fig. 3

Mombasa-Cairo Through Service,

Reproduced from East African Railways Timetable, Feb. 1962

SUMMARY TABLE No 2

DEPARTURES			KENYA AND UGANDA — SUDAN AND EGYPT											
SERVICE	MULTIPLY	F	STATION OR PORT		STATION OR PORT		STATION OR PORT		STATION OR PORT		STATION OR PORT		STATION OR PORT	
			B		East African Railways & Harbours		Sudan Railways		Sudan Republic Railways		Sudan Republic Railways		Sudan Republic Railways	
Rail	SU	1st car	1830	dep	MOMBASA R	arr	0800	11 23rd	Rail					
Rail	SU	2nd	0915	dep	NAIROBI	arr	1730	11 22nd	Rail					
Road	WV	4th	0900	dep	KAMPALA	arr	1715	11 21st	Rail					
Road	WV	4th	1309	arr	MASINDI TOWN Ho. B	arr	1300	11 21st	Road					
Road	WV	5th	0900	dep		arr	0800	11 21st	Road					
Steamer	SH	5th	1030	dep	BUTIABA J	arr	0800	11 20th	Road					
Steamer	TH	5th	2000	arr	PAKWACH J	arr	1000	11 19th	Steamer					
Steamer	SH	7th	0700	arr	NIMULE	dep	1300	11 18th	Steamer					
Road	SA	7th	1200	dep	NIMULE	arr	1100	11 18th	Road					
Road	SA	7th	1630	arr	JUBA	arr	0630	11 18th	Road					
Steamer	SU	8th	0530	dep		arr	1315	11 17th	Steamer					
Steamer	SA	14th	0700	arr	KOSTI	dep	1000	11 8th	Steamer					
Rail	SA	14th	1700	dep		arr	0355	11 8th	Rail					
Rail	SU	15th	0305	arr		arr	0355	11 8th	Rail					
Rail	SU	15th	0700	dep	KHARTOUM	dep	1315	11 7th	Rail					
Rail	SU	15th	1500	arr	ATBARA	arr	1700	11 5th	Rail					
Rail	SU	16th	0810	arr	WADI MALFA	arr	0840	11 5th	Rail					
Steamer	WV	16th	1030	arr		arr	1300	11 4th	Rail					
Steamer	TU	17th	1030	arr	SHELLAL	arr	0600	11 4th	Steamer					
Rail	TU	17th	1645	dep	SHELLAL	arr	1200	11 2nd	Steamer					
Rail	TU	17th	2110	arr	SHELLAL	arr	0750	11 2nd	Rail					
Rail	WV	18th	0855	arr	LUXOR	arr	2000	11 1st	Rail					
					CAIRO	arr								
ARRIVALS			STATION OR PORT											
			B		East African Railways & Harbours		Sudan Railways		Sudan Republic Railways		Sudan Republic Railways		Sudan Republic Railways	
			2		WEEKLY		SERVICE		DEPARTURES		SERVICE		DEPARTURES	

Causes of Deterioration of Earnings--Loss of Efficiency

There are two general and closely interrelated causes of the earnings deterioration, plus the effects of inflationary pressures not reflected in immediate rate changes; the first is the general decline in operating efficiency. This is manifest in the doubling of the turnaround time for freight cars over the last decade, the great increase in train delays, increased accidents and equipment failures, and many other facets. It is difficult to pinpoint the causes, but several are indicated by persons who have examined the operations in detail:

- a. Complete centralization of management despite the very wide area served.
- b. Location of the headquarters in Atbara rather than Khartoum, with endless delays in coordinating decision making with the Ministry of Transport and other government agencies. Atbara is nearly 200 miles from Khartoum, there is no paved road, and the average train time is 18 hours.
- c. A generally "noncommercial" attitude on the part of the railway--a tendency throughout to carry on the old monopoly attitude that reflected the actual situation two decades ago but no longer does--in other words, a failure to adapt to changed conditions.
- d. Low labor productivity, over staffing, and low employee morale. The productivity problems appear in part to reflect labor union policy; this is a strongly unionized sector of the economy. Apparently the wage structure is unrelated to work actually done. One cannot avoid the conclusion that the railway, despite reductions in recent years, is still greatly over staffed.
- e. A completely inadequate communications system, which increases delays and uncertainty.

f. Shortages of equipment, in turn aggravated by delays in repairs.

The percentage of diesel locomotives out of service and under repair in 1975 was 40 percent, compared to 20 percent in 1968--in other words, on the average during the year, nearly half of the road's diesels were out of service. The figure for the steam locomotives was 36 percent, compared to 20 percent in 1964.

g. Lack of adequate planning for handling traffic changes.

h. An inherent problem--seasonality of traffic: the peak traffic is two-thirds greater than the low period traffic.

Causes of Deterioration of Earnings--Road Transport

The rapid increase in road transport, in large part a product of inadequate quality of rail service, is the second cause of declining earnings. The cost of road transport is substantially greater, but the time saving is so great that shippers are willing to pay the greater cost. For example, between Port Sudan and Khartoum, the road transport time is from 2 to 3 days; by rail, priority freight may be delivered in 7 to 8 days, other freight from 10 to 15 days. The problem is not one of bad track or slow operating speeds, but rather from all indications, in terminal handling. Road transport is able to make this good time despite the lack of a road to Port Sudan; much of the way the vehicles merely operate across desert tracks.

No exact data of road transport traffic is available, but there are estimates. In 1970, total road transport volume was estimated to have been about .9 billion ton kilometers; by 1976 it had risen to 2.6 billion, exceeding the rail volume, which was 2.1/ billion ton km, It is estimated that road transport is carrying half or more of the rapidly growing ground nut

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In the second section, the author details the various methods used to collect and analyze the data. This includes both manual data entry and the use of specialized software tools. The goal is to ensure that the data is both accurate and easy to interpret.

The third section provides a detailed breakdown of the results. It shows that there is a significant correlation between the variables being studied. This finding is supported by statistical analysis and is consistent with previous research in the field.

Finally, the document concludes with a series of recommendations for future research. It suggests that further studies should be conducted to explore the underlying causes of the observed trends. This will help to refine the current model and provide more accurate predictions.

export traffic. Most of the road transport is handled by small private firms; a person gets the money to acquire one lorry and invests his profits to expand his fleet. There are a few large operators. The Sudan-Kuwaiti firm, financed from Kuwait, has become a major operator. There are two government-owned firms. The number of lorries increased from 11,000 to 24,000 from 1970 to 1974 alone; petrol for road use has doubled in this period; sales of diesel fuel had also doubled for 1966 to 1972. The most recent trend has been to use large tractor-trailer units with typical 35 metric ton (38.5 net ton) loads. Average traffic on various roads is shown on Table 7, and freight traffic of Sudan-Kuwaiti Transport in Table 8.

Prior to the mid-fifties, and in large measure until the early 1970s, the railroad was protected from road transport, primarily by the failure to build roads; the philosophy of the government apparently was that roads were unnecessary; the railroad could handle the traffic, and tracks through the desert could be used in the dry season.¹ In the 1930s the government actually prohibited road transport from Khartoum to Port Sudan, though it found enforcement difficult. Not until the mid-seventies was paving begun; the first paved road connected Khartoum with Wad Medani. As of 1976, there were only 400 km of paved road, 2,000 gravelled, out of a total of 18,000 km.

In recent years, however, the government, despite its ownership of the railway, has pushed road transport because rail transport was so inadequate. There are no entry licensing or rate controls, and transport vehicles are given favorable treatment under customs duties.

1. The policy is described by C. Wilkins, "Transport in the Sudan," in Ali Mohamed el Hassan, ed., An Introduction to the Sudan Economy (Khartoum: University of Khartoum Press, 1977), pp. 102-22.

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99. $\frac{1}{x^{100}} = x^{-100}$
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Table 7.

Average Daily Traffic on Roads in Sudan for 1973

Section	Length	Truck	%	Bus	%	Light	%	Total	%
Atbara-Berber	37	68	21	187	56	76	23	331	100
Khartoum-Wad Medani	187	728	23	217	19	215	18	1160	100
Wad Medani-Sennar	126	189	65	48	17	53	18	290	100
Kassala-Gedarif	223	205	89	15	6	11	5	231	100
Luiga-Gedarif	150	198	88	1	-	27	12	226	100
Sennar-Es Suki	60	352	85	11	3	49	12	412	100
Es Suki-Rosseiris	172	275	98	4	1	4	1	283	100
Singa-El Damazin	185	188	91	5	2	14	7	207	100
Rabak-Sennar	103	280	84	10	3	43	13	333	100
Rabak-Ed Dueim	100	228	86	20	8	16	6	264	100
Rabak-El Jebelin	72	178	84	18	9	15	7	211	100

Source: Louis Berger Inc., Report on Highway Design and Financing, 1973.

Note: Only, those roads and tracks where the traffic counts in 1973 were 200 vehicles or more, are included.

Table 8.

FREIGHT TRAFFIC HANDLED BY THE
SUDAN KUWAITI TRANSPORT COMPANY
BY ROUTE AND DIRECTION OF MOVEMENT
OCT. 15, 1975 - APRIL 30, 1976

Route	Distance Km	Commodity	Tons Carried	Ton/Km. (Million)
Khartoum - Port Sudan	1200	Oil Cakes	8,800	10.56
Port Sudan - Khartoum	1200	Cement	10,790	12.95
„ - Maringan	1390	Jute Cloth & Soare Parts	4,235	5.89
„ - Kassala	630	Cement	1,055	0.66
Maringan - Khartoum	190	Cotton Seed	8,600	1.63
New Halfa-Port Sudan	660	„ „	4,820	3.18
Gedarif - Port Sudan	852	Dura	5,800	4.94
Port Sudan - Gedarif	852	Cement	315	0.27
Gedarif - Khartoum	415	Dura	1,700	0.12
Sennar - Khartoum	303	Miscellaneous	2,100	0.62
Total			48,215	40.82

Source: Sudan-Kuwaiti Transport Company.

Tables 7 and 8 are reproduced from Sudan, Transport Statistical Bulletin, 1975.

Table 9.

General Characteristics of Roads in the Sudan 1974/75

	Length Km	Type	Seasonality	Low Capacity Period	Travel Time in Normal Season (Hours)	Travel Time in Low Capacity Season (Hours)
Khartoum-Wad Medani	187	Asphalt	All	-	4	4
Khartoum-Atbara	312	Track	All	-	12.5	12.5
Khartoum-Kosti	312	Track	Dry	July-Oct.	12.5	12.5
Khartoum-El Obeid	413	Track	All	-	20.5	20.5
Khartoum-Kassala	400	Track	Dry	July-Oct.	14	Closed
Khartoum-Dongola	547	Track	All	-	26	26
Port Sudan-Haiya	225	Track	Dry	July-Oct.	11	22
Port Sudan-Toker	160	Gravel	All	-	5	5
Kassala-Haiya	350	Track	Dry	July-Oct.	16	Closed
Haiya-Atbara	291	Track	Dry	July-Oct.	12	24
Gedarif-Kassala	223	Track	Dry	July-Oct.	9.5	Closed
Gedarif-Gallabat	150	Track	Dry	July-Oct.	5.5	Closed
Gedarif-Wad Medani*	235	-	-	-	-	-
Sennar-Wad Medani	126	Track	Dry	July-Oct.	4.2	Closed
Sennar-Kosti	103	Track	Dry	July-Oct.	3.5	Closed
Kosti-Malakal	508	Track	Dry	July-Oct.	21	Closed
Kosti-El Obeid	320	Track	Dry	July-Oct.	14	28
El Obeid-Kadugli	298	Gravel	All	-	9	9
En Nahud-El Fasher	452	Track	All	-	22	22
El Obeid-En Nahud	215	Track	All	-	10.5	10.5
En Nahud-Wau	675	Track	Dry	July-Oct.	23	66
En Nahud-Nyala	523	Track	Dry	July-Oct.	25	50
Nyala-Wau	690	Track	Dry	July-Oct.	33.5	66
Nyala-Zalingi	205	Track	Dry	July-Oct.	10.2	20
Nyala-El Fasher	225	Track	All	-	11	11
El Fasher-Geneina	356	Track	Dry	July-Oct.	18.35	35
Sennar-Rosseires	248	Track	Dry	July-Oct.	10.25	Closed
Dibeibat-Dilling-Kadugli	186	Asphalt	All	-	3	3..

Source: ADAR Transport Study (updated)

* Almost 50% asphalt and the rest gravel

The net effect has been to reduce rail volume materially on the light traffic lines, check its growth on the main lines despite increasing economic activity, and materially reduce rail earnings, since much of the traffic loss is in high-rate commodities. There appears, thus far, to have been little beneficial effect in stimulating greater rail efficiency.

No good overall figures are available on road transport costs, but figures are available on the Khartoum-Port Sudan traffic. The typical charge from Khartoum to Port Sudan (500 miles) for a 35 ton load is from L200 to L400; for a load back to Khartoum, L600 to L700. These are roughly twice the rail rates. In terms of US cents per ton mile, the outbound figures are 3 to 6 cents per ton mile, inbound figures, 8 to 9 cents per ton mile. The firms obviously regard the outbound haul as the back haul and quote low rates to obtain the traffic, but even these exceed most rail rates. A 1971 estimate indicated overall rail costs of L.0057 per ton-kilometer; L.016 for heavy road transport. A recent unpublished estimate shows an overall rail cost figure of L.0075, L.01 for road. Most figures suggest a greater differential, however.

Traffic Outside the Rail Area

In the southern portion of the country, there are no railroads, and all cargo must move by road or river. There is a certain amount of international trade with Uganda--imports of coffee, exports of manufactured goods, and there are imports of petroleum and cement from Kenya, and some trade with Chad, which has no good outlet to the sea. Again, roads are mainly tracks and unusable in the wet season--which is much more significant in the southern Sudan than it is in the north (see Table 9). There is a long-used track east and west across the Sudan, from Kosti and El Obeid through El Fasher

into Chad, leading on to West Africa--a route long used by caravans. Many pilgrims bring cattle with them and sell them in the Sudan, using a route farther south, ending in Kosti.¹

There is a road of a sort leading south from Kosti down the east side of the White Nile through Malakal to Juba and on into Uganda and into Zaire, but it is unsurfaced and unusable in wet weather. The primary form of transport from Kosti to Juba (1400 km) is by barge on the Nile; this is the major element in the water transport system, but is in urgent need of new equipment. Virtually all traffic is southbound. The only other stretch of water transport is from the end of the Karima rail line, across from Merowe, in the north, to Dongola (290 km)--the so-called Dongola reach. Water transport accounts for only about 2 percent of the total transport volume in the country.

Plans for the Future

The government has made several attempts already to aid Sudan Railways by providing additional diesels and other equipment and obtaining foreign technical advice. The general policy, outlined in the new 6-year plan, is to provide the railways with substantial additional funds and various incentives to improve--to give the railways a major opportunity to increase efficiency.¹ The predicted increase in rail traffic for the next six years is greater than the predicted increase in road traffic, to bring each to about 4.5 billion ton/km in 1983. The primary reason for this emphasis on rail transport is the substantially lower cost of volume movements by rail.

1. J. S. Birks, "The Mecca Pilgrimages by West African Pastoral Nomads," Journal of Modern African Studies, Vol. 56, (March 1977), pp. 47-58.

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At the same time, however, large amounts will be spent on road improvements, and within a year a paved road will be completed from Khartoum to Port Sudan.¹

A major change in the transport picture will be brought about by the completion of the petroleum products pipeline from Port Sudan to Khartoum within the next year (the project has run well behind schedule). Petroleum now accounts for about 25 percent of the railway's revenue (just as it does in East Africa); the heavy movement is on the route that the pipeline will parallel. One point of view is that the removal of the petroleum traffic will allow much greater efficiency in the handling of the other traffic; the other is that the net effect will be to increase the railway's deficit materially.

The key to success for the railway is not merely funds for additional equipment; it would appear that the two most important requirements are (1) reorganization in management and steps to improve labor relations, to gain greater efficiency, and (2) further revision in tariff structures, to enable the railway to obtain the traffic for which it has the greatest comparative advantage.

Conclusion

It is generally recognized that inadequate transportation has been a major obstacle to economic development in the Sudan. The inefficiency in recent years of the rail system and the very limited road development have without question hampered development. Difficulties with the railway, in turn, led to increased attention to road transport and the building of the

1. Estimates call for expenditure of about L87 million in the period 1976-80 for rail improvements (locomotives, cars, track), L150 million for road improvements, L11 million for river transport. These are, of course, subject to change.

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11. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

12. $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

13. $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$

14. $\frac{1}{8} \times \frac{1}{9} = \frac{1}{72}$

15. $\frac{1}{10} \times \frac{1}{11} = \frac{1}{110}$

16. $\frac{1}{12} \times \frac{1}{13} = \frac{1}{156}$

17. $\frac{1}{14} \times \frac{1}{15} = \frac{1}{210}$

18. $\frac{1}{16} \times \frac{1}{17} = \frac{1}{272}$

19. $\frac{1}{18} \times \frac{1}{19} = \frac{1}{342}$

20. $\frac{1}{20} \times \frac{1}{21} = \frac{1}{420}$

21. $\frac{1}{22} \times \frac{1}{23} = \frac{1}{506}$

22. $\frac{1}{24} \times \frac{1}{25} = \frac{1}{600}$

23. $\frac{1}{26} \times \frac{1}{27} = \frac{1}{702}$

24. $\frac{1}{28} \times \frac{1}{29} = \frac{1}{812}$

25. $\frac{1}{30} \times \frac{1}{31} = \frac{1}{930}$

26. $\frac{1}{32} \times \frac{1}{33} = \frac{1}{1056}$

27. $\frac{1}{34} \times \frac{1}{35} = \frac{1}{1190}$

28. $\frac{1}{36} \times \frac{1}{37} = \frac{1}{1332}$

29. $\frac{1}{38} \times \frac{1}{39} = \frac{1}{1482}$

30. $\frac{1}{40} \times \frac{1}{41} = \frac{1}{1640}$

31. $\frac{1}{42} \times \frac{1}{43} = \frac{1}{1806}$

32. $\frac{1}{44} \times \frac{1}{45} = \frac{1}{1980}$

pipeline--which will aggravate the financial problems of the railway. Yet the potential is substantial: the rail system is one of the most extensive in Africa, covering virtually all the producing areas and towns except in the far south, and cost per ton kilometer is clearly less than that of road transport. The great problem is: how to improve rail efficiency, and to this the government is giving substantial attention. Sudan faces the same problem that confronts other African countries with substantial rail systems: rail costs are substantially lower than road transport costs with adequate traffic, but poor rail service results in diversion to road and improvements in nonrail facilities--thus aggravating the problem with the railways. There are also long-range problems with the light traffic lines which are relatively long; unless traffic volume increases materially on these, it may be desirable ultimately to consider abandonment. This is not contemplated, quite wisely, at present. There is very little likelihood of any additional rail construction, except the rebuilding of the line into Suakin as this port is developed to supplement Port Sudan, now operating nearly to capacity.

July 14, 1976

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This not only helps in tracking expenses but also ensures compliance with tax regulations.

In the second section, the author provides a detailed breakdown of the monthly budget. It includes categories such as housing, utilities, food, and transportation. Each category is further divided into sub-items, allowing for a granular view of where the money is being spent.

The third section focuses on investment strategies. It suggests diversifying the portfolio to include both stocks and bonds. The author also mentions the importance of regularly reviewing the portfolio to ensure it remains aligned with the long-term financial goals.

Finally, the document concludes with a summary of the key points discussed. It reiterates the need for discipline and consistency in financial planning. The author encourages readers to take control of their finances and make informed decisions.

Category	Sub-Category	Amount	Notes
Housing	Rent	1200	Fixed monthly expense
	Utilities	150	Includes water, electricity, gas
	Maintenance	50	Emergency fund for repairs
Food	Home Cooking	300	Includes groceries and kitchen supplies
	Outgoing	100	Restaurants, coffee shops
Transportation	Gas	80	Based on current mileage
	Public Transport	40	Monthly pass
Savings	Emergency Fund	200	Targeting 6 months of expenses
	Retirement	100	Contributing to 401(k)
Total Monthly Budget			
		2070	



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